CLAIMS

1. System for switching optical signals with carrier wavelength conversion capacity, comprising a set of input ports (PE1-PEn), a set of output ports (PS1-PSn) functionally connected to the input ports so that an input signal presented to one of the input ports may be selectively routed to at least one of the output ports, and wavelength conversion means (34) providing a capacity for converting an input signal carrier wavelength to at least one other output port output wavelength,

characterized in that said wavelength conversion capacity of said conversion means (34) is limited by at least one of the following three limitation means i) to iii):

i) for at least one of said output ports (PS), no wavelength conversion may be applied for sending a signal from an input port;

ii) for at least one of said output ports (PS), wavelength conversion may be applied for sending a signal from an input port (PE), but to only a restricted number of wavelength values from the number L of different wavelength values accepted at the input, this restricted number being greater than 0 and less than L, and

iii) for only a restricted number of output ports (PS) less than the total number of output ports of the switching system, wavelength conversion may be applied for sending a signal from an input port (PE) to any wavelength value from the number L of different wavelength values accepted at the input.

2. System according to claim 1, characterized in that said wavelength conversion capacity of said conversion means (34) is limited so that wavelength conversion may be applied for sending a signal from an input port (PE1 to PEn) via any output port (PS1 to PSn), but only, at each of the output ports, to a restricted number x1 of wavelength values from the number L of different

wavelength values accepted at the input, x1 being greater than 0 and less than L.

3. System according to claim 1, characterized in that said wavelength conversion capacity of said conversion means (34) is limited so that wavelength conversion may be applied for sending a signal from an input port (PE1 to PEn) to any wavelength value from the number L of different wavelength values accepted at the input but only for switching to a restricted number x2 of output ports (PS1 to PSx2), x2 being greater than 0 and less than the number of output ports of the system.

4. System according to any of claims 1 to 3, characterized in that it is adapted to switch signals presenting in the form of optical data packets.

5. System according to any of claims 1 to 4, characterized in that said limitation of the capacity of the conversion means (34) is applied at the level of at least one of the output ports (PS), each output port at which said limitation is applied comprising a first number of signal line inputs from input ports (PE) and a second number L of output lines, this second number representing the number of different wavelengths at the output ports (PS), and at least one of the output lines of this second number of lines has no wavelength conversion means, serving only to send at the output a signal with the same wavelength as that at which the signal is received at the input.

6. System according to any of claims 1 to 5, characterized in that each output port (PS) at which a wavelength conversion limitation is applied comprises a simplified selection unit (42; 52) for grouping onto each output line, without conversion, signals coming from input lines having the same wavelength as the output

line, the unit further comprising, for each output line without conversion, spatial selector means (46; 56) for selecting input lines, said selector means having no spectral selection means and being coupled at their output by coupling means (48, 58) to said output line corresponding to the wavelength of the spatial selector unit.

7. System according to any of claims 1 to 6, characterized in that it further comprises temporal selection means (24) for delaying a signal from an input port (PE) before it is sent at the output of an output port (PS), the temporal selection means presenting to the output ports (PS) a number K of copies of signals received at the input ports (PE), each copy being time-shifted relative to the others.

8. System according to claim 7, characterized in that each output port (PS) at which a limitation of wavelength conversion is applied comprises a set of input lines leading to output lines provided with no conversion means, the set comprising, for a number n of input ports (PE1 to PEn), a number n*K of lines, one for each of said K time-shifted copies (24) coming from each of the n input ports.

9. System according to claim 1 or claim 2, claim 6 and claim 8, characterized in that said n*K lines of the set are presented to the input of said simplified selection unit (42), said unit producing a number (L-x1) of output lines equal to the total number L of different wavelength values accepted at the input of the system less said restricted number x1 of wavelength values for which carrier wavelength conversion is provided.

10. System according to claim 9, characterized in that each output port (PS) comprises a number x1 of sets of

input lines each leading to a respective one of x1 output lines with wavelength conversion and each comprising n*K input lines, said output port comprising n*K(x1+1) input lines, each of said x1 sets of lines further comprising, for each of the wavelength values of said restricted number x1 of wavelength values for which carrier wavelength conversion is provided:

- a spatial and temporal selection stage (27) receiving at its input a number n*K of input lines, one for each of said K time-shifted copies coming from each of the n input ports and, using a nK:L coupler (28), producing a number L of outputs equal to the total number L of wavelength values accepted at the input of the system,

- a wavelength selection system comprising a spatial selection stage (29) associated with a multiplexer (30) receiving said L outputs at its input and selectively producing one of them at its output, and

- wavelength conversion means (34) receiving at their input the output of said multiplexer (30) and connected at their output to an output line.

11. System according to claim 10, characterized in that it further comprises a multiplexer (36) with L inputs each receiving a respective one of the (L-x1) output lines of said simplified selection units and the x1 outputs of the set of multiplexers (30-1 to 30-x1) and an output sending on an output fiber (FS) of the corresponding output port.

12. System according to claim 1 or claim 2 and any of claims 4 to 11, characterized in that has a number n of input ports (PE) and a number n' of output ports (PS), the numbers n and n' being equal or different, each input port comprising a spectral multiplex comprising a number L of carriers having L respective wavelengths, the system further comprising:

- a first buffer stage (24) for imposing a number K of mutually time-shifted copies of each of the n optical input signals,

- a second stage for converting each of the n*K multiplexes from the first stage into a number of copies equal to n'*(x1+1), and

- a third selection stage for selecting L optical signals from the nK(x1+1) multiplexes received by an output port PS.

13. A system according to claim 1 or claim 3, claim 6 and claim 8, characterized in that said n*K lines of the set are presented to the input of said simplified selection unit (52), said block producing at its output a number (L) of output lines equal to the total number L of wavelength values accepted at the input of the system.

14. A system according to claim 13, characterized in that it further comprises a multiplexer (36) with L inputs each receiving a respective one of the (L) output lines of said simplified selection units and an output to an output fiber (FS) of the corresponding output port.

15. System according to any of claims 1 or 3 to 8, characterized in that it has a number n of input ports (PE) and a number n' of output ports (PS), the numbers n and n' being equal or different, each input port comprising a spectral multiplex comprising a number L of carriers having L respective wavelengths, and the system further comprising:

- a first buffer stage (24) for imposing a number K of mutually time-shifted copies of each of the n optical input signals,

- a second stage for converting each of the n*K signals from the first stage into a number of copies equal to L*x2+n'-x2, and

- a third selection stage for selecting L optical

signals from the n*KL multiplexes received by an output port PS with total wavelength conversion and for selecting L optical signals from the n*K multiplexes received by an output port (PS) without wavelength conversion.

16. Optical communications network (2) comprising at least one node (4) for connecting input and output lines, characterized in that said node comprises at least one switching system (10; 40; 50; 60) according to any of claims 1 to 15 connected to a set of input lines at its input ports (PE) and to a set of output lines at its output ports (PS).

17. Network according to claim 16, characterized in that the switching system is further connected to at least one gateway (70).

18. Network according to claim 16 or claim 17, characterized in that it manages contention by temporal distribution of packets, in particular if the packets in contention may not be subjected to wavelength conversion because of said limitation of wavelength conversion capacity, and by spectral and temporal distribution of packets, in particular if the packets in contention may be subjected to wavelength conversion.

19. Use of a switching system (10) according to any of claims 1 to 15 for switching data streams in a communications network node with management of contention by temporal distribution of the data streams, in particular if the data streams in contention may not be subjected to wavelength conversion because of said limitation of wavelength conversion capacity, and by spectral and temporal distribution of the data streams, in particular if the streams in contention may be subjected to wavelength conversion.

20. Method of switching optical signals with a carrier wavelength conversion capacity, comprising a set of input ports (PE1-PEn), a set of output ports (PS1-PSn) functionally connected to the input ports so that an input signal presented to one of the input ports may be selectively routed to at least one of the output ports, wavelength conversion means (34) for providing a capacity for converting an input signal carrier wavelength to at least one other output wavelength at the output of an output port,

characterized in that said wavelength conversion capacity is limited by using at least one of the following three limitation possibilities i) to iii):

i) for at least one of said output ports (PS), no wavelength conversion may be applied for sending a signal from an input port;

ii) for at least one of said output ports (PS), wavelength conversion may be applied for sending a signal from an input port (PE), but to only a restricted number of wavelength values from the number L of different wavelength values accepted at the input, this restricted number being greater than 0 and less than L, and

iii) for only a restricted number of output ports (PS) less than the total number of output ports of the switching system, wavelength conversion may be applied for sending a signal from an input port (PE) to any wavelength value from the number L of different wavelength values accepted at the input.

21. Method according to claim 20, characterized in that said wavelength conversion capacity is limited so that wavelength conversion may be applied for sending a signal from an input port (PE1-PEn) via any output port (PS1-PSn) but, for each of the output ports, only to a restricted number x1 of wavelength values from the number L of different wavelength values accepted at the input,

x1 being greater than 0 and less than L.

22. Method according to claim 20, characterized in that said wavelength conversion capacity is limited so that conversion may be applied for sending a signal from an input port (PE1-PEn) to only a restricted number x2 of the number <u>n</u> of output ports (PS1 to PSx), x2 being greater than 0 and less than the number of output ports, but with a capacity for wavelength conversion to any wavelength value of the number L of different wavelengths accepted at the input.

23. Method according to any of claims 20 to 22, characterized in that it uses a system according to any of claims 1 to 15.